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(71)Applicant : MINEBEA CO LTD

(72)Inventor : HANS HELMUT
LAUER MANFRED

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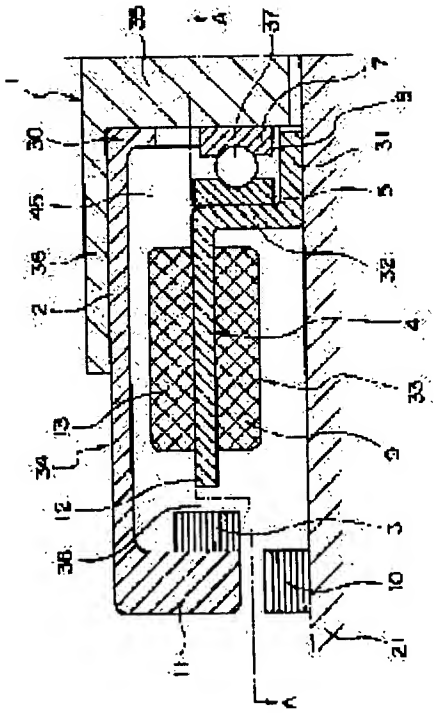
(54) SPINDLE MOTOR

(57)Abstract:

PROBLEM TO BE SOLVED: To reduce the thickness of a spindle motor.

SOLUTION: A space 45 between a base plate 21 and a rotor disc 2 of a rotor 34 is formed, to have a dimension enough to accommodate a stator 33 with teeth 13 to which coils 9 are applied. A bearing 8, by which the rotor 34 can rotate relatively to the stator 33 and a prepressure load means 10 and 40, are provided in the space 45. The stator 33 is formed to have steps in the cross-section in the axial direction to increase the strength.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the small spindle motor of a thin form, and the thing especially used for a hard disk drive.
[0002]
[Description of the Prior Art] There is a small spindle motor also in the former in the thin form where an outer diameter is 30mm - 40 mm, and height is 5mm - 8 mm. In this small spindle motor, the thickness of a stator becomes very thin, and in order to prevent the bad influence by the eddy current originally, as for the core which should be made into a laminated structure, only one core plate will be ******(ed). However, since the bearing assembly which consists of two bearing for precompression is attached, Rota juxtaposed by this and shaft orientations has been the failure which lessens thickness (height) of a stator and is made into a thin form, in order for a part of bearing part [at least] to jump out of Rota.
[0003] In order to use a thing different from a stator, the member which fixes a stator to a base plate cannot lessen about [that simplification of the structure of a stator cannot be attained], and components mark, and cannot aim at the fall of a manufacturing cost.
[0004]
[Problem(s) to be Solved by the Invention] This invention is by arranging without precompression protruding the precompression load means which carries out the load of the precompression at the bearing by which a load is carried out, and this from this space in the space formed with Rota and a base plate to make a spindle motor into a thin shape.
[0005]
[Means for Solving the Problem] In order to solve this technical problem, the spindle motor based on this invention A base plate, the shaft arranged at the right angle at this, and Rota arranged pivotable centering on a shaft, The stator which has the tooth part of the one-sheet object around which the coil prolonged in radial [of a shaft] in between a base plate and Rota was wound, and is fixed to a base plate, It has one bearing prepared between a stator and a shaft or between a stator and Rota. Are arranged so that a stator may be surrounded in Rota at the periphery, and form in inner skin the outside attaching part which prepared the annular permanent magnet for rotation which stands face to face against a stator, and it grows into it. Spacing between a stator and a base plate and spacing between a stator and Rota are set up so that it may become predetermined spacing of extent to which the outside surface of a coil does not contact a base plate and Rota. The precompression load means which carries out the load of the precompression to bearing and bearing is installed in the space formed between Rota and a base plate, and it is constituted.
[0006] In one mode, a stator is formed by the middle body which is prolonged in between the annular fixed part which surrounds a shaft and is fixed to a base plate, and the peripheral faces of an annular fixed part and the inner edges of a tooth part, and connects the peripheral face of an annular fixed part, and the inner edge of a tooth part. And a shaft is a revolving shaft which Rota is connected and rotates with Rota, bearing has the outer ring of spiral wound gasket by which checking and verifying are carried out to the middle body of a stator, and the inner ring of spiral wound gasket fitted in a shaft, and a pressure overload means is the magnet for precompression loads which stood face to face against the end face by the side of the base plate of the outside attaching part of Rota, and was fixed to the base plate beforehand.
[0007] Beforehand, even if it stands face to face against the end face of the outside attaching part of Rota and is formed in a sector (circular segment), the magnet for pressure overloads stands face to face against the end face of the outside attaching part of Rota, and may be formed annularly. Moreover, beforehand, the magnet for pressure overloads may be a permanent magnet, or may be an electromagnet.

[0008] The revolving shaft which a shaft is connected in Rota and rotates with Rota is set as a spindle motor. Moreover, a stator It has the body for bearing maintenance which is prolonged from the inner skin of the annular fixed part of a stator to the direction in Rota in the space formed between Rota and a base plate, and surrounds a shaft. Bearing It is formed in the end section of these shafts and the body for bearing maintenance between a shaft and the body for bearing maintenance. Fitting of the outer ring of spiral wound gasket of bearing is carried out to the body for bearing maintenance, and the inner ring of spiral wound gasket of bearing is fitted in the shaft. Beforehand a pressure overload means It is formed in the other end of a shaft and the body for bearing maintenance between a shaft and the body for bearing maintenance, has the outer ring of spiral wound gasket by which fitting was carried out to the body for bearing maintenance, and the inner ring of spiral wound gasket fitted in the shaft, and can also constitute from other bearing which carries out the load of the precompression to bearing.
[0009] The fixed shaft fixed to the base plate in the shaft is set as a spindle motor. Furthermore, a stator It has the 1st body for bearing maintenance by which is prolonged from the inner skin of the annular fixed part of a stator to the direction in Rota in the space formed between Rota and a base plate, and fitting is carried out to a shaft. Rota has the 2nd body for bearing maintenance prolonged [to / from the inner skin / near the annular fixed part of a stator]. Bearing It is formed in the end section of these 1st and 2nd bodies for bearing maintenance between the 1st and 2nd bodies for bearing maintenance. The inner ring of spiral wound gasket of bearing is fitted in the 1st body for bearing maintenance, and fitting of the outer ring of spiral wound gasket of bearing is carried out to the 2nd body for bearing maintenance. Beforehand a pressure overload means It is also desirable to constitute from other bearing which is formed in the other end of these 1st and 2nd bodies for bearing maintenance between the 1st and 2nd bodies for bearing maintenance, has the outer ring of spiral wound gasket by which fitting was carried out to the inner ring of spiral wound gasket and the 2nd body for bearing maintenance which were fitted in the 1st body for bearing maintenance, and carries out the load of the precompression to bearing.
[0010]
[Embodiment of the Invention] Hereafter, with reference to a drawing, this invention is explained based on an operation gestalt.
[0011] Drawing 1 and 2 show the 1st operation gestalt of the spindle motor of this invention. 4 is a core plate, and it is fixed to a base plate 21 and it has the annular fixed part 31 and the middle body 32 prolonged upwards from the periphery in Fig. 1. The rectangle-like tooth part 13 is prolonged on the radial outside from the upper limit of the middle body 32. Although, as for the tooth part 13, only one piece is shown in drawing 2 , predetermined plurality is arranged at equal intervals to the circumferencial direction of the middle body 32. The hammer section 12 is formed in the outer edge of each tooth part 13. This core plate 4 is really an object, and the plastics material containing ferromagnetics and ferromagnetics, such as steel containing cobalt, is used.
[0012] A coil 9 is wound around each tooth part 13. And the height of the middle body 32 is set up so that predetermined distance alienation of the peripheral face of the coil 9 wound around the tooth part 13 may be carried out from a base plate 21. Here, the core plate 4 and a coil 9 constitute a stator 33.
[0013] It is really Rota of an object, and 34 consists of the rotor disk section 2, the inside attaching part 30 of the shape of a cylinder caudad prolonged from the inner circumference section of the center, and the outside attaching part 11 of the shape of a cylinder caudad prolonged from the periphery of the rotor disk section 2, and is iron. The permanent magnet 3 for rotation is arranged by the inner skin of the outside attaching part 11 over the perimeter.
[0014] A revolving shaft 1 has the medial-axis section 35 and the disc-like flange 36 formed in the upper limit among drawing 1 at this and a coaxis. Fitting of the medial-axis section 35 is carried out to the inside attaching part 30 of Rota 34, and the flange 36 is being fixed to the top face of the rotor disk section 2 of Rota 34 by adhesives in the inferior surface of tongue.
[0015] Through bearing 8, the revolving shaft 1 which constitutes the shaft of a spindle motor is attached to a stator 33 so that it may become the core plate 4 and a coaxis. Bearing 8 consists of the rolling element 37 (in illustration, it is a ball) arranged an outer ring of spiral wound gasket 5, an inner ring of spiral wound gasket 7, and between them, and fitting of the peripheral face of an outer ring of spiral wound gasket 5 is carried out to the inner skin of the middle body 32 of the core plate 4. An inner ring of spiral wound gasket 7 is fitted in the medial-axis section 35 of a revolving shaft 1. Thus, it is attached in a shaft 1 so that Rota 34 may rotate to a stator 33 and a coaxis. The width of face of bearing 8 is set as the magnitude in which there is no part from which the peripheral face of the outer ring of spiral wound gasket 5 separates, and a part all carries out a pressure welding to the inner skin of the middle body 32 of the core plate 4.
[0016] When Rota 34 is attached in this way, it is arranged so that predetermined distance alienation of the inferior surface of tongue of the rotor disk section 2 of Rota 34 may be carried out from the coil 9 wound around the tooth part 13 of the core plate 4. Moreover, the permanent magnet 3 for rotation stands face to face against the hammer section 12

of the heel of each tooth part 13 with the predetermined air gap 38 in this case.
[0017] a sector (circular segment) as are shown in drawing 1 and 2 and shown as a continuous line -- or it fixes on a base plate 21 so that adjustment confrontation of the annular magnet [coaxis / a revolving shaft 1] 10 for precompression loads (a permanent magnet or electromagnet) may be carried out on the inferior surface of tongue of the outside attaching part 11 of Rota 34 at shaft orientations, as shown by the broken line. This magnet 10 for precompression loads lengthens Rota 34 caudad in drawing 1 in the lower limit of that outside attaching part 11, and carries out the load of the precompression to bearing 8. In addition, in drawing 2 , illustration of the rolling element 37 of bearing 8 is omitted.
[0018] Next, actuation of the spindle motor of this operation gestalt is explained. If a predetermined direction and a predetermined, predetermined current are passed in a coil 9, since the core plate 4 and Rota 34 are conductors, a closed magnetic circuit will be formed by the upper limit section of drawing 1 of the middle body 32 of the core plate 4, and the outside attaching part 11 of Rota 34, and the magnetic flux of the specified quantity of the predetermined direction will generate them between the hammer section 12 and the permanent magnet 3 for rotation through an air gap 38. By this, Rota 34 is rotated in a predetermined rate and the predetermined direction.
[0019] Under the present circumstances, although it will be unevenly distributed in precompression to bearing 8 and a load will be carried out, when the magnet 10 for pressure overloads is beforehand made into a sector at drawing 2 , as a continuous line shows, since there are few [Rota 34] clearances in bearing 8, Rota 34 inclines to the direction of the magnet 10 for pressure overloads, i.e., the left-hand side in drawing 1 , slightly beforehand in a revolving shaft 1. However, this inclination is always fixed to left-hand side in the fixed direction, i.e., drawing 1 , to the magnet 10 for pressure overloads beforehand. Therefore, in order to rotate as a core the axial center which inclined at the fixed include angle in this direction, Rota 34 does not carry out a precession and carries out exact rotation. On the other hand, since the outside attaching part 11 of Rota 34 is equally lengthened below by drawing 1 over the perimeter when annular as the magnet 10 for pressure overloads shows beforehand drawing 2 with a broken line, the load of the equal precompression is carried out to bearing 8 over the perimeter. In addition, the magnet 10 for pressure overloads constitutes a pressure overload means beforehand.
[0020] In the spindle motor of the 1st operation gestalt constituted as mentioned above It prepares [bearing / 8] with the magnet 10 for pressure overloads beforehand in the space between the rotor disk sections 2 of Rota 34 and the base plates 21 which were constituted thinly, and was made for these not to overflow this space. The tooth part 13 of the stator 33 prepared in such space is also thin, and since the length of the coil 9 which was being wound around this also becomes low, and this space can be constituted narrowly, thickness (height) of a spindle motor can be made small.
[0021] Moreover, by having formed the magnet 10 for pressure overloads beforehand, the number of bearing can be reduced from two conventional pieces to one piece, and this also contributes to reduction with the thickness (height) of a spindle motor, and cost.
[0022] Furthermore, since the annular fixed part 31 is formed in one as a part of stator 33, while the member for fixing a stator 33 to a base plate 21 separately from a stator 33 is less necessary and simplifies the configuration of a spindle motor, this can also perform cost reduction.
[0023] Furthermore, since the stator 33 has the middle body 32, a stator 33 becomes strong.
[0024] Drawing 3 shows the 2nd operation gestalt of the spindle motor of this invention. The differences with the 1st operation gestalt of this operation gestalt are using the bearing of a pair and having not formed the magnet for pressure overloads beforehand, and that the body for bearing maintenance is prepared in the annular fixed part of a stator.
[0025] the body 39 for bearing maintenance which reaches near the inferior surface of tongue of the flange 36 of a revolving shaft 1 from the inner circumference section of the annular fixed part 31 of a stator 33 as illustration -- the annular fixed part 31 and one -- and it forms in the medial-axis section 35 of a revolving shaft 1, and a coaxis. An inner ring of spiral wound gasket 7 is fitted in the lower part of the medial-axis section 35 of a revolving shaft 1 for bearing up and down with those with a pair, and the structure as the bearing 8 of the 1st operation gestalt where the lower bearing 8 is the same, and fitting of the outer ring of spiral wound gasket 5 is carried out to the lower part of the body 39 for bearing maintenance of a stator 33. Moreover, the upper bearing 40 consists of the inner ring of spiral wound gasket 41 fitted in the upper part of the medial-axis section 35 of a revolving shaft 1, the outer ring of spiral wound gasket 42 by which fitting was carried out to the upper part of the body 39 for bearing maintenance, and the rolling element (in illustration, it is a ball) 43 arranged between outer rings of spiral wound gasket among these, and it is arranged so that the load of the precompression may be carried out to the lower bearing 8. Therefore, the upper bearing 40 constitutes a precompression addition means.
[0026] Since both bearings 8 and 40 are moreover arranged in the space between the inferior surface of tongue (top face of Rota 34) of the flange 36 of a revolving shaft 1, and the top face of a base plate 21 between the medial-axis section

35 of a revolving shaft 1, and the body 39 for bearing maintenance of a stator 33 It cannot overflow after this in the flange 36 of a revolving shaft 1, the top face of a base plate 21, and the space of a between, therefore the thickness (height) of a spindle motor can be decreased. Since the configuration of other elements is the same as the case of the 1st operation gestalt, the same reference number is attached and shown in the same element, and those explanation is omitted.

[0027] Drawing 4 shows the 3rd operation gestalt of the spindle motor of this invention. As for a different point from the 2nd operation gestalt of this operation gestalt, a shaft does not have a flange, and it being a fixed shaft and the body for bearing maintenance of a stator are being held at the fixed shaft, and that Rota has a body for bearing maintenance.

[0028] As shown in drawing 4 , shaft 1A is the fixed shaft by which set-up immobilization was carried out at the base plate 21, and the body 39 for bearing maintenance of a stator 33 (1st body for bearing maintenance) is fitted in this. Other bodies 44 for bearing maintenance (2nd body for bearing maintenance) are formed so that it may extend [to / from the inner circumference section of Rota 34 / near the top face of the annular fixed part 31 of other stators 33] caudad and this body 39 for bearing maintenance may be surrounded by shaft 1A and the body 39 for bearing maintenance of a stator 33, and the coaxis.

[0029] Although the lower bearing 8 and the upper bearing 40 are formed similarly to them of the 3rd operation gestalt The peripheral face of the outer ring of spiral wound gasket 5 of the lower bearing 8 is contacted by the inner skin bottom of the 2nd body 44 for bearing maintenance of Rota 34. The inner skin of the inner ring of spiral wound gasket 7 is contacted by the peripheral face bottom of the 1st body 11 for bearing maintenance. The peripheral face of the outer ring of spiral wound gasket 42 of the upper bearing 40 is contacted by the inner skin bottom of the 2nd body 44 for bearing maintenance of Rota 34, and the inner skin of the inner ring of spiral wound gasket 41 is contacted by the peripheral face bottom of the 1st body 11 for bearing maintenance. And the upper bearing 40 constitutes the precompression load means which carries out a load to the lower bearing 8.

[0030] Both bearings 8 and 40 to the space between the top face of the rotor disk section 2 of Rota 34, and the top face of the annular fixed part 31 of a stator 33 And since it is arranged between the body 44 for Rota 34 bearing maintenance, and the body 39 for bearing maintenance of a stator 33 It cannot overflow into the top face and stator 33 of the rotor disk section 2 of Rota 34 in the space between the top faces of the annular fixed part 31 after this, therefore the thickness (height) of a spindle motor can be decreased. Since the configuration of other elements is the same as the case of the 3rd operation gestalt, the same reference number is attached and shown in the same element, and those explanation is omitted.

[0031] Although the body 39 for the 1st bearing maintenance was formed in the core plate 4, this may not be formed but the inner skin of the inner rings of spiral wound gasket 7 and 41 of both bearings 8 and 40 may be made to contact the peripheral face of direct shaft 1A in the 3rd operation gestalt of drawing 4 . Other structures are the same as the 3rd operation gestalt.

[0032] Since it stated above, with the precompression load means which consists of the bearing 40 which carries out the load of the magnet 10 for precompression loads or precompression which gives precompression to the bearing 8 which receives precompression, a top has the top face of the rotor disk section 2 of Rota 34, and the bottom in the space between the top faces of a base plate 21 as it being high as it is low. The reference number 45 is given to the space formed with Rota 34 and a base plate 21 through all operation gestalten. Moreover, in the 2nd and 3rd operation gestalt, although upper bearing 40 is beforehand used as the bearing of the object for pressure overloads, i.e., the side which considers as a pressure overload means beforehand and receives precompression for the lower bearing 8, contrary to this, bearing 8 can also be beforehand used as the bearing of the object for pressure overloads, i.e., the side which considers as a pressure overload means beforehand and receives precompression for bearing 40.

[0033]

[Effect of the Invention] Since a pressure overload means' being beforehand arranged in the space between Rota and a base plate with the bearing from which this invention's receives precompression, and this space have the low height decided by total coil thickness wound around the tooth part with a thin stator, they are effective in the ability to make thickness (height) of a spindle motor small. Moreover, since the stator has structure in a completely different class, it is effective in reinforcement increasing.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is drawing of longitudinal section in the left half of the 1st operation gestalt of a spindle motor based on this invention.
[Drawing 2] It is a top view on the left-hand side of the spindle motor seen by A-A of drawing 1 , and only one tooth part of a stator is shown.
[Drawing 3] It is drawing of longitudinal section in the left half of the 2nd operation gestalt of a spindle motor based on this invention.
[Drawing 4] It is drawing of longitudinal section in the left half of the 3rd operation gestalt of a spindle motor based on this invention.
[Description of Notations]
1 Shaft (Revolving Shaft)
1A Shaft (fixed shaft)
2 Rotor Disk Section
3 Permanent Magnet for Rotation
4 Core Plate
5 Outer Ring of Spiral Wound Gasket
7 Inner Ring of Spiral Wound Gasket
8 Bearing
9 Coil
10 It is Magnet for Pressure Overloads (Beforehand Pressure Overload Means) Beforehand.
11 Outside Attaching Part
12 Hammer Section
13 Tooth Part
21 Base Plate
30 Inside Attaching Part
31 Annular Fixed Part
32 Middle Body
33 Stator
34 Rota
35 Medial-Axis Section
36 Flange
37 Rolling Element
38 Air Gap
39 1st Body for Bearing Maintenance
40 Bearing (Beforehand Pressure Overload Means)
41 Inner Ring of Spiral Wound Gasket
42 Outer Ring of Spiral Wound Gasket
43 Rolling Element
44 2nd Body for Bearing Maintenance
45 Space

[Translation done.]

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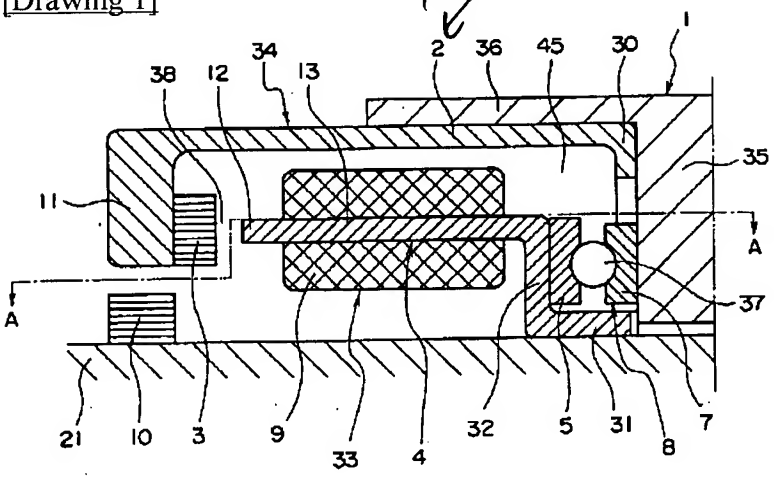
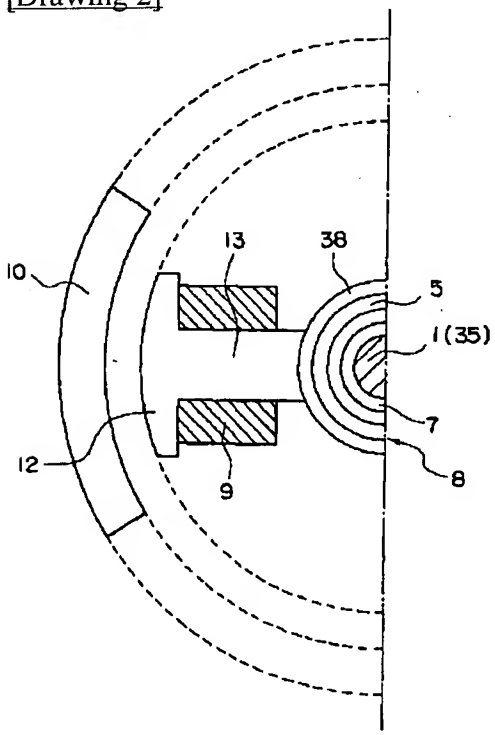
DRAWINGS

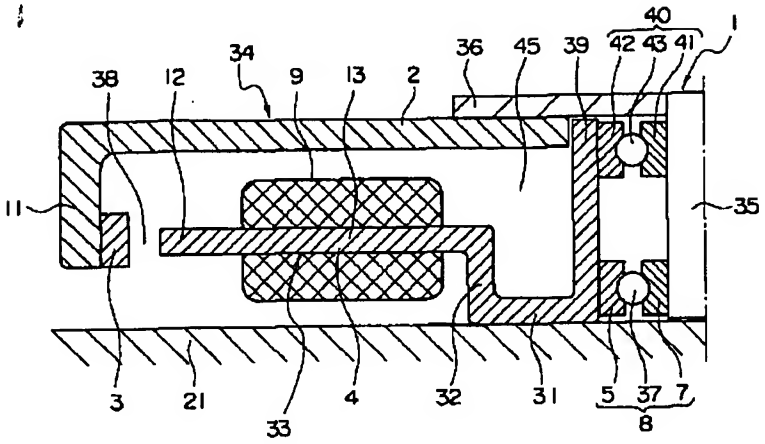
[Drawing 1]



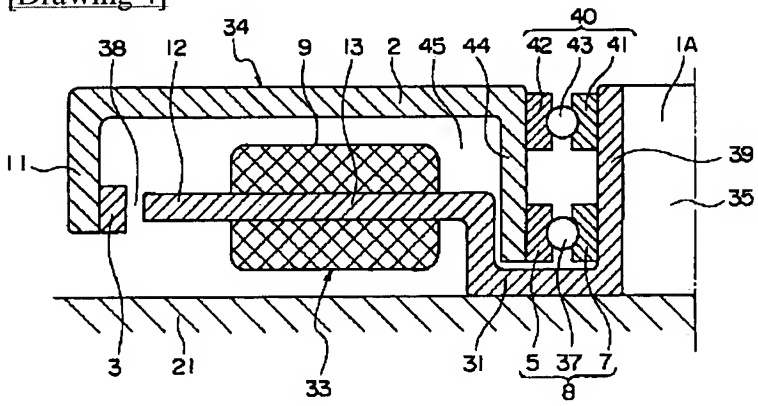
[Drawing 2]



[Drawing 3]



[Drawing 4]



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